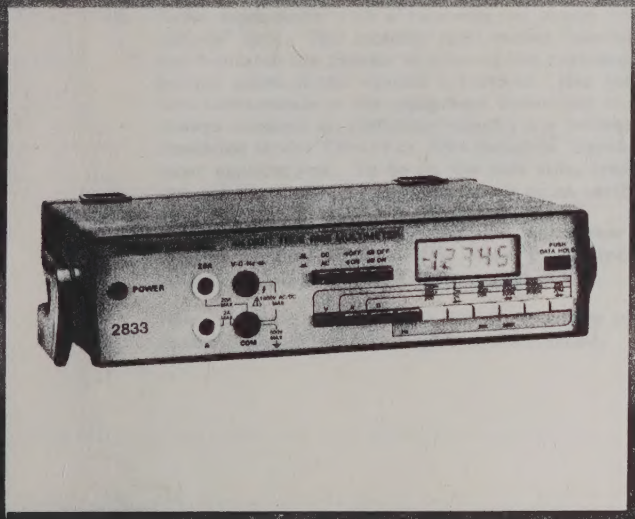
ROCKFORD INSTRUMENT LAB
1718 Broadway
Rockford, IL 61104

# INSTRUCTION MANUAL

BK PRECISION
DYNASCAN CORPORATION

# MODEL 2833




## Bench Type
## 4-1/2 Digit
## TRUE RMS MULTIMETER

BK PRECISION
DYNASCAN CORPORATION

ROCKFORD INSTRUMENT LAB
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(continued from inside front cover)

5. For voltage or current measurements in high voltage equipment, do not touch equipment, meter, or test leads while power is applied.

6. If possible, familiarize yourself with the equipment being tested and the location of its high voltage points. However, remember that high voltage may appear at unexpected points in defective equipment.

7. Use an insulated floor material or floor mat to stand on, and an insulated work bench surface; make certain such surfaces are not damp or wet.

8. Keep "one hand in the pocket" while handling an instrument probe. Be particularly careful to avoid contacting a nearby metal object that could provide a good ground return path.

9. When using a probe, touch only the insulated portion. Never touch the exposed tip portion.

10. Some equipment with a two-wire ac power cord, including some with polarized power plugs, is the "hot chassis" type. This includes most recent television receivers and audio equipment. A plastic or wooden cabinet insulates the chassis to protect the customer. When the cabinet is removed for servicing, a serious shock hazard exists if the chassis is touched. Not only does this present a dangerous shock hazard, but damage to test instruments or the equipment under test may result. To make measurements in "hot chassis" equipment, always connect an isolation transformer between the ac outlet and the equipment under test. The **B & K-Precision** Model TR-110 or 1604 Isolation Transformer, or Model 1653 or 1655 AC Power Supply is suitable for most applications. To be on the safe side, treat all two-wire ac powered equipment as "hot chassis" unless you are sure it has an isolated chassis or an earth ground chassis.

11. When testing ac powered equipment, remember that ac line voltage is usually present on some power input circuits such as on-off switch, fuses, power transformer, etc. any time the equipment is connected to an ac outlet, even if the equipment is turned off.

12. Never work alone. Someone should be nearby to render aid if necessary. Training in CPR (cardio-pulmonary resuscitation) first aid is highly recommended.

## TEST INSTRUMENT SAFETY

**WARNING**

*An electrical shock causing 10 milliamps of current to pass through the heart will stop most human heartbeats. Voltage as low as 35 volts dc or ac rms should be considered dangerous and hazardous since it can produce a fatal current under certain conditions. Higher voltages are even more dangerous. Observe the following safety precautions:*

1. Do not exceed the following input ratings. Personal injury or damage to the instrument may result.

| | |
|---|---|
| DC VOLTS | 1000 V (dc + ac peak) |
| AC VOLTS | 1000 V rms |
| OHMS | 250 V dc or ac rms |
| 200 µA-2A | 2 A (fuse protected) |
| 20 A | 20 A (no overload protection) |
| COM | Do not float more than 500 volts from earth ground. |

2. Remove test leads from the instrument and point of measurement before replacing fuses or performing any servicing on the multimeter.

3. Use only shrouded safety type test leads like those supplied. Periodically inspect insulation for any burns, cuts, or breaks. Never use test leads with exposed bare wires or poor insulation.

4. Turn off equipment while making test connections in high-voltage circuits. Discharge high-voltage capacitors after removing power.

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## INTRODUCTION

The **B & K-Precision** Model 2833 bench-type 4-1/2 digit true rms multimeter is a highly versatile instrument which offers portability as well as precision. In addition to the usual digital multimeter functions of ac & dc voltage, ac & dc current, and resistance measurements, the Model 2833 measures dBm and frequency. Also included are diode test, continuity, and data hold functions.

The high resolution 4-1/2 digit display and corresponding high accuracy (0.05% for dc voltage measurements) make the instrument suitable for almost any application.

The true rms reading feature allows the meter to be used for a wide variety of ac signals. Unlike standard average value detection meters, true rms allows accurate measurements of triangle waves, square waves, sawtooth waves, and other non-sinusoidal repeating waveforms.

The instrument is easy to use, as all functions are selected from a panel of very logically laid out and identified push-buttons. The 4-1/2 digit LCD display features visual continuity, minus sign, and low battery annunciators. The unit is housed in a rugged, attractive plastic case, and the carrying handle doubles as a sturdy tilt stand. The tilt stand can be folded under the instrument to allow stacking with your other instruments.

Although the instrument is a bench unit with the features expected in a bench unit, the instrument can also be operated from six "C"-cell batteries, providing full portability.

Safety features include safety jacks, safety test leads, and extensive overload protection, including a high energy fuse.

**B & K-Precision** offers a full line of optional accessories for the Model 2833 which can further expand the capabilities and usefulness of the instrument.

## SPECIFICATIONS

Accuracy is specified for temperature range of 18°C - 28°C (75% max RH).

### GENERAL SPECIFICATIONS

Display:
4-1/2 digit LCD. Displays to 19999 counts.

Ranging:
Manual ranging.

Over Range Indication:
"1" appears on leftmost character of display with all other digits blanked.

Polarity Indication:
Positive polarity assumed, minus (-) sign for negative polarity.

Sampling:
2 times/sec (nominal).

Maximum Common Mode Voltage:
500 V (dc + ac peak).

Calibration:
1 year for specified accuracy.

Temperature Coefficient (0° - 18°C and 28° - 40°C):
Specified accuracy x 0.1/°C.

Temperature Range:
Operation: 0 to +50° C, 70% RH.
Storage: -20° to +60° C, 80% RH.

Power Requirements:
115 V ±10%, 50-60 Hz, 1 W using supplied ac adapter.
9 Vdc using six "C"-cell batteries.

Battery Life:
Approximately 1000 hours using alkaline cells.

Low Battery Indication:
"LO BAT" appears on display when battery voltage is low.

Fuses:
Double fused. 250 V, 2 A and 600 V, 4 A.

Dimensions (W x H x D):
240 x 64 x 190 mm (9.4 x 2.5 x 7.5").

Weight:
Approximately 1.7 kg (3-3/4 lb).

## DC VOLTAGE

| RANGE | RESOLUTION | ACCURACY | INPUT IMPEDANCE |
|---|---|---|---|
| 200 mV | 10 µV | ±(0.05% +3 counts) | greater than 1000 MΩ |
| 2 V | 100 µV | ±(0.05% +3 counts) | 11 MΩ |
| 20 V | 1 mV | ±(0.05% +3 counts) | 10 MΩ |
| 200 V | 10 mV | ±(0.05% +3 counts) | 10 MΩ |
| 1000 V | 100 mV | ±(0.05% +3 counts) | 10 MΩ |

Response Time:
3 second max to rated accuracy within selected range.

Overload Protection (2 V to 1000 V ranges):
1000 V DC or AC rms max.

Overload Protection (200 mV range):
500 V DC or AC rms max.

NMRR:
Greater than 50 dB (50/60 Hz).

CMRR:
Greater than 100 dB (50/60 Hz).

## SPECIFICATIONS

**AC VOLTAGE** (True rms)
Specifications apply for input values greater than 10% full scale.

| RANGE | RESOLUTION | FREQUENCY | ACCURACY | INPUT IMPEDANCE |
|---|---|---|---|---|
| 200 mV | 10 µV | 45 Hz to 1 kHz | ±(0.5% + 20 counts) | greater than 1000 MΩ, less than 100 pF |
| | | 1 kHz to 20 kHz | ±(1% +40 counts) | |
| | | 20 kHz to 50 kHz | ±(5% +40 counts) | |
| 2 V | 0.1 mV | 45 Hz to 300 Hz | ±(0.5% +10 counts) | 11 MΩ, less than 100 pF |
| | | 300 Hz to 20 kHz | ±(1% +40 counts) | |
| | | 20 kHz to 50 kHz | ±(5% +40 counts) | |
| 20 V | 1 mV | 45 Hz to 1 kHz | ±(0.5% +10 counts) | 10 MΩ, less than 100 pF |
| | | 1 kHz to 20 kHz | ±(1% +40 counts) | |
| | | 20 kHz to 50 kHz | ±(5% +40 counts) | |
| 200 V | 10 mV | 45 Hz to 1 kHz | ±(0.5% +10 counts) | 10 MΩ, less than 100 pF |
| | | 1 kHz to 20 kHz | ±(1% +40 counts) | |
| | | 20 kHz to 50 kHz | ±(5% +40 counts) | |
| 1000 V | 0.1 V | 45 to 400 Hz | ±(1% +10 counts) | 10 MΩ, less than 100 pF |

Response Time:
3 seconds max to rated accuracy within selected range.

Crest Factor:
3.

Overload Protection (2 V to 1000 V ranges):
1000 V DC or 1000 V AC rms max.

Overload Protection (200 mV range):
500 V DC or AC rms max.

## DC CURRENT

| RANGE | RESOLUTION | ACCURACY | BURDEN VOLTAGE |
|---|---|---|---|
| 200 µA | 10 nA | ±(0.3% rdg +10 counts) | 300 mV (max.) |
| 2 mA | 100 nA | ±(0.3% rdg +10 counts) | 300 mV (max.) |
| 20 mA | 1 µA | ±(0.3% rdg +10 counts) | 300 mV (max.) |
| 200 mA | 10 µA | ±(0.3% rdg +10 counts) | 300 mV (max.) |
| 2000 mA | 100 µA | ±(0.75% rdg +10 counts) | 900 mV (max.) |
| 20 A | 1 mA | ±(1.0% rdg +10 counts) | 900 mV (max.) |

Response Time:
3 second max to rated accuracy within selected range.

Overload Protection (200 µA to 2000mA ranges):
2 A, 250 V and 4 A, 600 V fuses.
Overload Protection (20 A range):
No fuse.

## SPECIFICATIONS

**AC CURRENT** (True rms, ac coupled)
Specifications apply for input values greater than 10% of full scale.

| RANGE | RESOLUTION | FREQUENCY | ACCURACY | BURDEN VOLTAGE |
|---|---|---|---|---|
| 200 µA | 10 nA | 45 Hz to 10 kHz | ±(1.0% rdg + 10 counts) | 300 mV rms (max.) |
| | | 10 kHz to 20 kHz | ±(2.0% rdg + 20 counts) | |
| 2 mA | 100 nA | 45 Hz to 10 kHz | ±(1.0% rdg + 10 counts) | 300 mV rms (max.) |
| | | 10 kHz to 20 kHz | ±(2.0% rdg + 20 counts) | |
| 20 mA | 1 µA | 45 Hz to 10 kHz | ±(1.0% rdg + 10 counts) | 300 mV rms (max.) |
| | | 10 kHz to 20 kHz | ±(2.0% rdg + 20 counts) | |
| 200 mA | 10 µA | 45 Hz to 10 kHz | ±(1.0% rdg + 10 counts) | 300 mV rms (max.) |
| | | 10 kHz to 20 kHz | ±(2.0% rdg + 20 counts) | |
| 2000 mA | 100 µA | 45 Hz to 2 kHz | ±(1.0% rdg + 10 counts) | 900 mV rms (max.) |
| 20 A | 1 mA | 45 Hz to 2 kHz | ±(2.0% rdg + 10 counts) | 900 mV rms (max.) |

Response Time:
3 seconds max to rated accuracy within selected range.

Crest Factor:
3.

Overload Protection (200 µA to 2000 mA ranges):
2 A, 250 V fuse and 4 A, 600 V high-energy fuse.

Overload Protection (20 A range):
No fuse.

**RESISTANCE**

| RANGE | RESOLUTION | ACCURACY | Typ. TEST CURRENT | MAX OPEN CIRCUIT VOLTAGE |
|---|---|---|---|---|
| 200 Ω | 0.01 Ω | ±(0.2% +5 counts +0.04 Ω) | 1 mA | Approx 3.4 V |
| 2 kΩ | 0.1 Ω | ±(0.1% +3 counts) | 1 mA | Approx 3.4 V |
| 20 kΩ | 1 Ω | ±(0.1% +3 counts) | 10 µA | Approx 3.4 V |
| 200 kΩ | 10 Ω | ±(0.5% +3 counts) | 10 µA | Approx 3.4 V |
| 2000 kΩ | 100 Ω | ±(0.5% +3 counts) | 0.1 µA | Approx 3.4 V |
| 20 MΩ | 1 kΩ | ±(1% +3 counts) | 0.1 µA | Approx 3.4 V |

Response Time:
200 Ω - 200 kΩ range: 3 seconds max to rated accuracy within selected range.
2000 kΩ range: 5 seconds max to rated accuracy within selected range.
20 MΩ range: 25 seconds max to rated accuracy within selected range

**Overload Protection:**
500 V DC or AC rms max.

## SPECIFICATIONS

**dBm MEASUREMENT** (True rms, ac coupled)
0 dBm= 0.7746 Vrms (600 Ω, 1 mW). Accuracy specified for values over 10% of full scale.

| dB/VOLTAGE RANGE | METER RANGE | ACCURACY | | | |
|---|---|---|---|---|---|
| | | 45 Hz to 1 kHZ | 1 kHz to 10 kHZ | 10 kHz to 20 kHz | 20 kHz to 50 kHz |
| -48 dB to -31.76 dB (3.08 mV to 19.99 mV) | 200 mV | ±1 dB | ±1.5 dB | not specified | |
| -31.76 dB to -11.76 dB (20 mV to 199.9 mV) | 200 mV | ±0.6 dB | ±0.6 dB | ±2.0 dB | ±2.5 dB |
| -11.76 dB to 8.24 dB (200 mV to 1.9999 V) | 2 V | ±0.6 dB | ±0.6 dB | ±2.0 dB | ±2.5 dB |
| 8.24 dB to 28.24 dB (2 V to 19.999 V) | 20 V | ±0.6 dB | ±0.6 dB | ±2.0 dB | ±2.5 dB |
| 28.24 dB to 48.24 dB (20 V to 199.99 V) | 200 V | ±0.6 dB | ±0.6 dB | ±2.0 dB | ±2.5 dB |
| 48.24 dB to 62.21 dB (200 V to 1000 V) | 1000 V | ± 0.6 dB | not specified | | |

**CONTINUITY CHECK**

Available on all resistance ranges. Threshold is nominal 100% of scale on 200 Ω, 20 kΩ, and 2 MΩ ranges; 10% nominal of scale on 2 kΩ, 200 kΩ, and 20 MΩ ranges.

Display:

Annunciator and resistance value displayed, tone sounds if resistance below continuity threshold.

**FREQUENCY MEASUREMENT**

(Input to V-Ω-Hz Jack)

| RANGE | RESOLUTION | ACCURACY (5 Vrms max) |
|---|---|---|
| 20kHz | 1 Hz | ± (0.75% rdg + 3 digits) |
| 200kHz | 10 Hz | ± (0.75% rdg + 3 digits) |

Sensitivity:

100 mV minimum.

Useable Range:

20 Hz to 199.9 kHz

Overload Protection.

250V DC or AC rms max.

**DIODE TEST**

Method:

Three resistance ranges assigned as diode test ranges. Measures forward resistance across semiconductor junction.

| RANGE | TEST CURRENT (diode forward current) |
|---|---|
| 2 kΩ | 1 mA |
| 200 kΩ | 10 µA |
| 20 MΩ | 0.1 µA |

## ACCESSORIES

### ACCESSORIES SUPPLIED

AC Adapter.

One Set Safety Test Leads, 1 red, 1 black.

One Spare Fuse, 2.0 A.

Instruction Manual.

Schematic Diagram & Parts List.

### OPTIONAL ACCESSORIES

CP-1 Clamp-On AC Current Probe.

HV-6 High Voltage Probe, 6 kV.

PR-28 High Voltage Probe, 40 kV.

PR-23 Demodulator Probe.

PR-21 Isolation/Direct Probe.

FP-10 High-Current Test Leads.

FP-30 Replacement Test Lead Set.

## CONTROLS AND INDICATORS

1. **POWER Switch.** Turns instrument ON and OFF. Power-on indicated by presence of characters on display.

2. **20 A Jack.** Input for 20 amp DC or AC current range.

**CAUTION**

*Do not exceed 20 A maximum input.*

3. **V Ω Hz⏭⊢ Jack.** Input jack for voltage measurement, resistance measurement, diode testing, continuity testing, and frequency measurement.

**CAUTION**

*Do not exceed the MAXIMUM INPUT RATINGS listed on the inside front cover of this manual.*

4. **DC/AC Switch.** Selects DC or AC in voltage and current functions. Engage switch (set to "in" position) for DC, disengage switch (set to "out" position) for AC.

5. •)) **ON/OFF Switch.** When resistance function is selected, this switch enables audible CONTINUITY TEST. Continuity tone is enabled when switch is engaged.

6. **dB ON/OFF Switch.** Selects dBm measurement function. Engage switch for dBm units, disengage switch for linear (volt, amp) units.

7. **Display.** 4-1/2 digit LCD display with automatic decimal point and minus (-) sign. Indicates to 19999 counts. Annunciators for continuity and low battery condition. Overrange indicated by a "1" displayed at the leftmost digit while all other digits remain blank.

8. **DATA HOLD Switch.** Holds the reading displayed at the moment this switch is pressed. Push "in" for data hold, "out" to turn off data hold.

9. **20 A/ 20 MΩ/⏭⊢ Switch.** Selects 20 A range for DC current and AC current functions and 20 MΩ range for resistance function. Also selects 20 MΩ diode test (⏭⊢) range.

10. **1000 V/ 2000 mA/ 2000 kΩ Switch.** Selects 1000 V range for DC voltage and AC voltage functions, 2000 mA range for DC current and AC current functions, and 2000 kΩ range for resistance function.

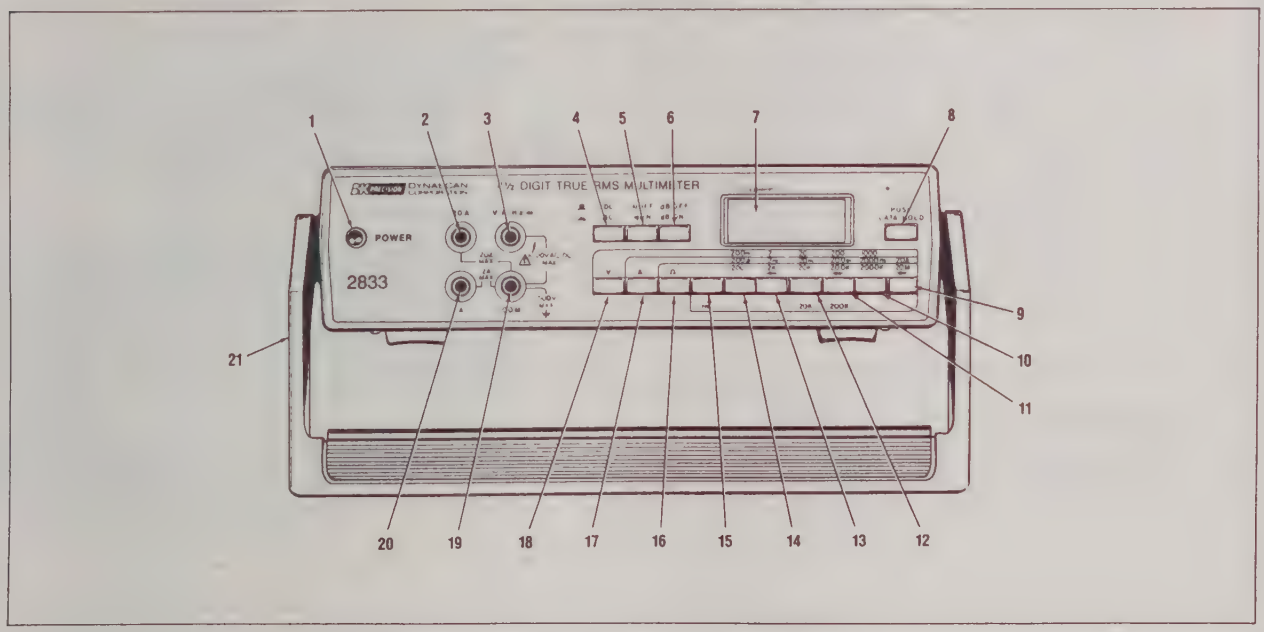


Fig. 2. Front Panel Controls and Indicators.

11. **200 V/ 200 mA/ 200 kΩ/ 200 kHz/⊣◀ Switch.** Selects 200 V range for DC voltage and AC voltage functions, 200 mA range for DC current and AC current functions, 200 kΩ range for resistance function, and 200 kHz range for frequency function. Also selects 200 kΩ diode test (⊣◀) range.

12. **20 V/ 20 mA/ 20 kΩ/ 20 kHz Switch.** Selects 20 V range for DC voltage and AC voltage functions, 20 mA range for DC current and AC current functions, 20 kΩ range for resistance function, and 20 kHz range for frequency function.

13. **2 V/ 2 mA/ 2 kΩ/⊣◀ Switch.** Selects 2 V range for DC voltage and AC voltage functions, 2 mA range for DC current and AC current functions, and 2 kΩ range for resistance function. Also selects 2 kΩ diode test (⊣◀) range.

14. **200 mV/ 200 µA/ 200 Ω Switch.** Selects 200 mV range for DC voltage and AC voltage functions, 200 µA range for DC current and AC current functions, and 200 Ω range for resistance function.

15. **Hz Switch.** Selects frequency measurement function.

16. **Ω Switch.** Selects resistance function.

17. **A (amp) Switch.** Selects current function.

18. **V Switch.** Selects voltage function.

19. **COMmon Jack.** Input for common test lead for all measurements.

**CAUTION**

*Connect to earth ground or reference point not more than 500 volts (dc + ac peak) from earth ground.*

20. **A (amp) Jack.** Input for 200 µA to 2 A DC or AC current range.

**CAUTION**

*Do not exceed 2.0 A maximum input.*

21. **Handle/Tilt Stand.**

22. **FUSE** (not shown). 2.0 A fuse. Overload protection for 200 µA to 2 A current range. Located on rear panel.

23. **Battery Compartment** (not shown). Pull-out tray with provision for six "C" cell batteries. Opens with thumbscrew located on rear panel. Also includes storage area for test leads and spare fuse.

24. **AC Adapter Jack** (not shown). Jack for connection to supplied ac adapter.

**WARNING**

*Use of test equipment may expose the operator to electric shock hazards. Observe all instructions contained in the TEST INSTRUMENT SAFETY section of this manual before using this instrument.*

**CAUTION**

*The TEST INSTRUMENT SAFETY section of this manual lists maximum voltage and current input limits which must be observed. Failure to adhere to these limits may result in damage to the instrument.*

## POWER SOURCES

The Model 2833 can be used as a bench instrument, powered from the ac adapter. Additionally, the instrument can be operated in field applications, powered from six internally-contained "C"-cell batteries (not supplied).

1. To power the instrument from an ac outlet, connect the ac adapter to the **AC Adapter Jack**. Plug adapter into ac outlet.

2. To power the instrument from batteries, install batteries (refer to "battery installation" instructions in the MAINTENANCE section of this manual).

**NOTE**

Do not attempt to recharge rechargable batteries (i.e., "ni-cads", etc.) with the batteries installed in instrument using the ac adapter. When the ac adapter is connected to the adapter jack, the batteries are disconnected from the instrument power bus. Additionally, the supplied ac adapter is not intended for such use.

## VOLTAGE MEASUREMENTS

1. Press the **V** function switch.

2. Select DC or AC measurement using **DC/AC** switch. Set for DC measurement by setting switch to

disengaged ("out") position. Push switch "in" for AC measurement.

3. If the voltage to be measured is unknown, start with the **1000 V** range.

4. When an approximate voltage range is known, simply press the switch for the range desired. Greatest resolution is attained using the range closest to an overrange for the voltage being measured.

5. Connect the red test lead to the **V Ω Hz** ⊣◀ jack and the black test lead to the **COM** jack.

6. Connect the test leads across the circuit points to be measured.

7. Read the measured value from the display.

## CURRENT MEASUREMENTS

**CAUTION**

*For current measurements, the meter must be connected in* ***series*** *with the load. If incorrectly connected (in parallel with the load), the meter presents a very low impedance (almost a short), which may blow the fuse or damage the meter or equipment under test. The 20 A range has no fuse protection and may severely damage the meter or equipment under test or cause personal injury.*

*For current measurements greater than 2 A, high current test leads should be used. High current measurements with standard test leads could cause the leads to heat up, or in extreme cases, to melt. This not only affects the accuracy of the measurement, but could result in injury to the operator.*

1. Press the **A** function switch.

2. Select DC or AC measurement using **DC/AC** switch. Set for DC measurement by setting switch to OUT position. Push switch IN for AC measurement.

3. If the current to be measured is unknown, start with the meter in the **20 A** range, using the **20 A** jack. *If the expected current might exceed 2 A, use high current test leads.*

4. When an approximate current range is known, simply press the switch for the range desired. Greatest resolution is attained using the range closest to an overrange for the current being measured.

a. For current measurements of 2 A or less, connect the red test lead to the A jack and the black test lead to the **COM** jack.

b. For current measurements greater than 2 A, connect a red *high current* test lead to the **20 A** jack and connect a black *high current* test lead to the **COM** jack.

5. Remove power from the circuit under measurement and open the normal circuit path where the measurement is to be taken. Connect the meter *in series* with the circuit.

6. Apply power to the circuit and read the measured value on the display.

## RESISTANCE MEASUREMENTS

1. *Remove power from the equipment under test.*

2. Press the **Ω** function switch.

3. Connect the red test lead to the **V Ω Hz** ⊣◀ jack and the black test lead to the **COM** jack.

4. Connect the test leads to the desired point of measurement and observe the reading on the display.

5. If the expected resistance range is unknown, start with the lowest range. If an overrange is indicated, continue selecting higher ranges until the overrange indication ceases. At this range, greatest resolution is achieved.

## CONTINUITY TESTING

1. First, perform steps 1 through 4 of RESISTANCE MEASUREMENTS. Activate the continuity tone by pressing the •)) switch to the engaged ("in") position. The continuity display annunciator is always enabled regardless of continuity switch position.

2. If the continuity sensed by the meter is below the continuity threshold of the selected range, the continuity tone will sound and the continuity annunciator will appear.

3. Press the •)) switch to the disengaged ("out") position to disable continuity tone.

## DIODE TESTING

1. Perform steps 1 through 3 of RESISTANCE MEASUREMENTS.

2. The recommended resistance ranges for checking diodes are denoted by a ⊣◀ symbol appearing below the corresponding resistance range switches.

3. The **2 kΩ** range (1 mA test current) is recommended for most diodes and junctions. The **200 kΩ** range (10 µA test

current) or **20 MΩ** range (0.1 µA test current) may be used for lower-current devices, such as germanium diodes and junctions.

4. The meter uses conventional-current lead polarity for diode testing (i.e., current flow assumed from positive-to-negative).

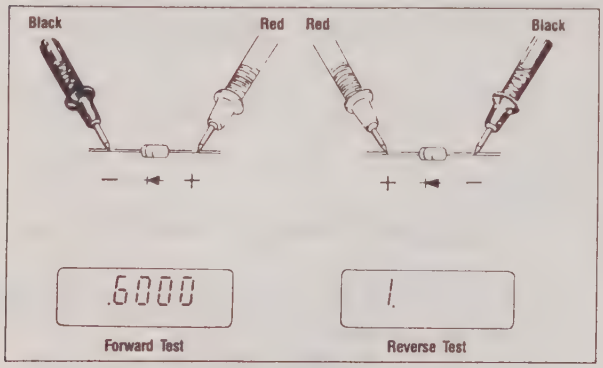


Fig. 3. Diode Test.

5. To check forward-bias condition of a diode, place the black test on cathode and the red test lead on anode. Properly functioning diodes will be forward-biased with this lead orientation and a relatively low resistance should be indicated. An overrange display under this condition indicates an open diode or junction.

6. To check reverse-bias condition of a diode, place the red test lead on the cathode and the black test lead on the anode. Properly functioning diodes will give an overrange display, indicating very high reverse resistance. A reading less than overrange indicates a leaky diode.

## FREQUENCY MEASUREMENTS

1. Press the **Hz** switch.
2. For accurate measurements, the level of the signal being measured should be greater than 60 mV.
3. Connect the red test lead to the **V Ω Hz** ⏩| jack and the black test lead to the **COM** jack.
4. Connect the test leads to the circuit point to be measured.
5. The frequency will be directly displayed in kHz.

## dBm MEASUREMENTS

The dBm function is actually an ac voltage measurement scaled to read in dBm. 0 dBm equals 0.7746 V rms (1 mW into 600 Ω). If the measurement is taken across an impedance

other than 600 Ω, use Fig. 4 to determine the meter correction factor. Algebraically add the correction factor (in dB) to the meter reading (in dB) for the correct value in dBm.

1. To select the dBm measurement function, set the **dB OFF/dB ON** switch to the engaged ("in") position.

2. Connect the red test lead to the **V Ω Hz** ⊣◀ jack and the black test lead to the **COM** jack.

3. Connect the test leads to the circuit to be measured.

4. When using the **dBm** function for dB ratio measurements (such as S/N measurements or filter curve tests), the meter range may be down-ranged from the reference setting as needed to get an on-scale reading. No multipliers or scaling factors are required. Read dB directly from the readout.

The dBm mode may also be used for dB measurements. For example, to measure the gain of an amplifier, measure the input and output level. If input and output impedances are equal, direct subtraction of the two readings gives the gain in dB. If impedances are unequal, and dB power gain rather than dB voltage gain measurement is required, use the meter correction factor chart of Fig. 4. A similar method would be used to measure the attenuation of a passive device.

The chart in Fig. 5 may be used to calculate the power level when the rms voltage level, in either volts or dBm, and the impedance are known.

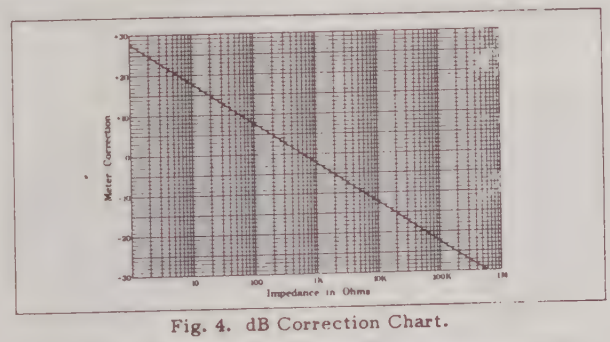


Fig. 4. dB Correction Chart.

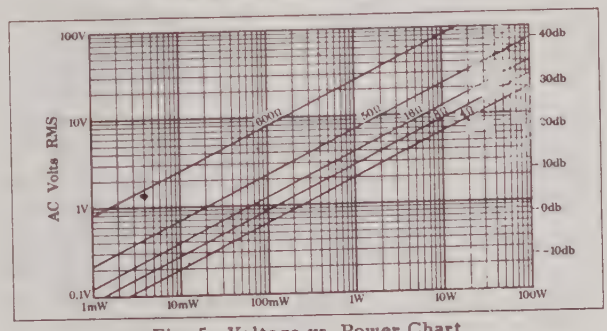


Fig. 5. Voltage vs. Power Chart (Sine Wave Conditions Only).

## DATA HOLD

Pressing the **DATA HOLD** switch (setting to the engaged position) holds the value that is displayed (latches the reading into the display). The reading stays on the display even after the test leads have been removed from the circuit. Data hold works on all functions. To cancel the data hold function, press the **DATA HOLD** switch again (setting switch to the disengaged position).

## TRUE RMS MEASUREMENTS

When measuring ac signals, undistorted sinewaves are not always encountered. For example, commonly encountered waveforms include squarewaves, triangle waves, and sawtooth waveforms, in addition to irregular noise signals encountered in communications and audio, logic signals and power consumption waveforms. With average-value detection, the measurement of these waveforms is accompanied by a large error. The average-value detection method is suitable for measurement of only low-distortion sine waves, after which the value is multiplied by 1.11 to create an rms displayed value (hence the term average-sensing, rms indicating). Non-sinusoidal signals and irregular waveforms require measurement by a technique which derives the rms value without regard to the waveform.

The crest factor of a signal is an important parameter in determining ac measurement accuracy, and is defined as the ratio of the signal peak value to its rms value. Commonly encountered signals such as distorted sinewaves, square waves, and triangle waves have low crest factor values (less than 2), while such signals as switching power supply current and noise signal waveforms have high crest factor values (more than 2). Commonly encountered signals and their corresponding crest factors are given in Fig. 6.

| Input Waveform | True rms Value (ac) | True rms Value (dc+ac) | Response Error Factor (avg/rms) | Crest Factor ($V_p/V_{rms}$) |
|---|---|---|---|---|
| Sine Wave | 1.000 | 1.000 | 1.000 | 1.414 |
| Triangle Wave | 1.000 | 1.000 | 0.960 | 1.732 |
| Square Wave | 1.000 | 1.000 | 1.110 | 1.000 |
| Full-wave Rectified | 0.435 | 1.000 | 0.421 | 1.414 |
| Half-wave Rectified | 0.771 | 1.000 | 0.764 | 2.000 |
| Pulse (50% duty) | 0.707 | 1.000 | 0.785 | 1.414 |
| Pulse D= a/b | $\frac{\sqrt{D-D^2}}{D}$ | 1.000 | $\frac{1.11\sqrt{D-D^2}}{D}$ | $\frac{1}{\sqrt{D}}$ |

Fig. 6. Relationship of Other Waveforms to a Sinewave.

**WARNING**

*The following instructions are for use by qualified service personnel only. To avoid electrical shock, do not perform servicing other than contained in the operating instructions unless you are qualified to do so.*

*Remove test leads from instrument and point of measurement before performing any servicing.*

## CASE REMOVAL AND REPLACEMENT

1. Remove the test leads and disconnect adapter.
2. Lay the instrument on its back for access to the retaining screws.
3. Remove the two Phillips head screws that retain the rear rubber feet. Do not remove the rear rubber feet. Remove the two Phillips head screws located next to the front rubber feet. These screws secure the top case to the bottom case.
4. Turn the instrument over. Fully loosen battery compartment door screw, but keep storage tray fully pushed in. Gently lift off the top case, pulling straight up. Do not try to completely clear case halves from each other at this point.
5. Note the small-gage red wire which serves as the shield foil ground wire. Disconnect this wire from the shield foil by removing Phillips head screw which retains spade lug to shield foil.
6. Unsolder the 18-gage red and green wires that connect the rear panel fuseholder to the PC board. Case halves can now be adequately separated to make circuit board accessible.
7. Replace the top case by reversing the procedure. Be sure to reconnect the shield foil ground wire, making certain that the spade lug tab makes contact with the shield foil. Connect the red fuse wire to the fuseholder center connection and the green wire to the outer connection.
8. When reassembling case, make certain of the following points:
   a. Battery leads and ground wire must clear case mounting spacers before tightening case screws.

b. Tilt stand is properly positioned within case cut-outs.

c. Rear and front panels are properly indexed with the corresponding case slots.

When case halves are properly reassembled, top case half will rest flush with bottom case half without additional force.

## FUSE REPLACEMENT

If current measurements are not possible on the 200 μA through 2000mA ranges, check for blown overload protection fuse which is contained in the rear panel fuseholder. Replace only with original type 2 A, 250 V normal blow 3 AG fuse (Dynascan part number 190-251-9-001).

The unit also includes a high energy fuse to protect against accidental connection to high energy sources. The high energy fuse is a 1-3/8 x 13/32" BBS cartridge-type fuse mounted inside the unit on the main circuit board, and is retained by a fuse clip. An opened condition is not readily visible with this type of fuse. Therefore, verify fuse condition with a continuity test. Replace a blown fuse only with original type 4 A, 600 V high energy fuse (Dynascan part number 194-008-9-001). Under normal operation, this fuse should not require replacement for the life of the instrument. If you suspect a blown fuse, always check the rear panel fuse first.

## TEST LEADS

*Use only shrouded safety type test leads, like those suppli* Periodically examine the test leads to ensure that the c ductors are not intermittent or broken. Also make sure t good contact pressure exists at the test lead receptacles a fuseholder, and keep these areas free from dirt and corrosi For safety from electrical shock, periodically check for e dence of damage to the insulation. Never use test leads w exposed bare wires. cracked insulation, or burned spots on t insulation. *Use only high-current leads for measureme above 2 A.*

## BATTERY INSTALLATION

1. **Battery compartment** door is located on instrument re panel. Loosen thumbscrew to open door.

2. Remove test leads and spare fuse from compartme Pull tray towards outside of instrument.

3. When tray is fully pulled out, tilt the tray downward access batteries.

4. Remove exhausted batteries by prying cell free fro battery holder using a small screwdriver (or other sui able tool).

5. Install six "C"-cell batteries noting correct polarity, shown in fig. 7.

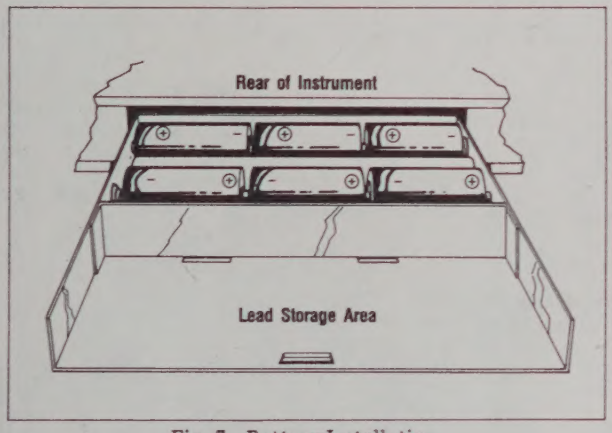


Fig. 7. Battery Installation.

**CAUTION**

*Make certain batteries are installed properly, noting correct polarity, before turning instrument on.*

*Do not remove black plastic battery holder from metal tray. Battery holder leads may be damaged.*

6. Tilt metal tray up and push into compartment. Hand-tighten thumbscrew.

## INSTRUMENT REPAIR AND CALIBRATION SERVICE

Because of the specialized skill and test equipment needed for instrument repair and calibration, many customers prefer to rely upon **B & K-Precision** authorized service agencies for this purpose. To use this service, even if you multimeter is no longer under warranty, follow the instructions given in the WARRANTY SERVICE INSTRUCTIONS portion of this manual. There is a nominal charge for instruments out of warranty.

## ADDITIONAL SERVICING INFORMATION

Refer to the separately supplied Schematic Diagram & Parts List. An experienced instrument technician can perform most servicing with this document as a reference. Requests for additional servicing information should be directed to Factory Service Operations at the address listed in the WARRANTY SERVICE INSTRUCTIONS. Be sure to specify Model 2833.

## WARRANTY SERVICE INSTRUCTIONS

1. Refer to the MAINTENANCE section of your **B & K-Precision** instruction manual for adjustments that may be applicable.

2. If the above-mentioned does not correct the problem you are experiencing with your unit, pack it securely (preferably in the original carton or double-packed). Enclose a letter describing the problem and include your name and address. Deliver to, or ship PREPAID (UPS preferred in U.S.A.) to the nearest **B & K-Precision** authorized service agency (see list enclosed with unit).

If your list of authorized **B & K-Precision** service agencies has been misplaced, contact your distributor for the name of your nearest service agency, or write to:

**B & K-Precision**, Dynascan Corporation
Factory Service Operations
6460 West Cortland Street
Chicago, Illinois 60635
Tel (312) 889-8870
Telex: 25-3475

Also use this address for technical inquiries
and replacement parts orders.